

Dashain Assignment 2074

Physics - XI

SET A

Short Questions

1. The diameter of a steel rod is given as (56.47 ± 0.02) mm. What does it mean?
2. The force F is given in terms of time ' t ' and displacement ' x ' by the equation: $F = A \cos Bx + C \sin Dt$. Find the dimension of $\frac{D}{B}$, A and C .
3. If the magnitudes of vectors \vec{A} , \vec{B} and \vec{C} are 3, 4 and 5 units respectively and $\vec{A} + \vec{B} = \vec{C}$. Find (i) angle between \vec{A} and \vec{B} (ii) angle between \vec{A} and \vec{C} .
4. If a vector has zero magnitude, is it meaningful to call vector? Explain.
5. Because of air resistance two objects of unequal mass do not fall at precisely the same rate. If two bodies of identical shape but unequal mass be dropped simultaneously from the same height, which one reaches the ground first?
6. Can a body have a constant speed but a varying velocity?
7. The direction in which an object moves is given by the direction of velocity and not by the direction of acceleration, why?
8. A student claimed that thermometers are useless because a thermometer always registers its own temperature. How would you respond?
9. Why is it sometimes possible to loosen caps on screw top bottles by dipping the cap briefly in hot water?
10. Why do different materials possess different specific heat capacity?
11. If a spherical mirror is immersed in water, does its focal length change?
12. Why does the sun look a little oval when it is at the horizon?
13. It is difficult to perform electrostatics experiments on humid day, why?
14. Why sharp edges or points are strictly avoided in electrical machines?

Long Questions

1. Define dimensions, dimensional formula and dimensional equation of a physical quantity. What are the various uses of dimensional analysis? Also discuss its limitations.
2. State the parallelogram Law of vector addition. Derive the expression for the magnitude and direction of the resultant of two vectors inclined at an angle θ from each other.
3. A projectile is fired with a velocity u and making an angle θ with the horizontal. Derive expression for (a) maximum height (b) Time of flight (c) horizontal range. Also find the condition for maximum horizontal range.
4. A projectile is fired with a velocity u and making an angle (θ) with the vertical. Derive expression for (a) maximum height (b) Time to reach maximum height (c) horizontal range.
5. Define coefficient of linear and superficial expansion. Show that $\beta = 2\alpha$.
6. Define the coefficient of real and apparent expansion of liquid and derive the relation between them.
7. Define specific heat capacity of substance. Describe the method of mixture to determine the specific heat capacity of a solid.
8. Prove that $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$, for convex mirror, where u , v and f have usual meanings.
9. Define real and apparent depth. Deduce the relation, $\mu = \frac{\text{real depth}}{\text{apparent depth}}$
10. What do you mean by electric charge? Discuss its type, properties and method of charging a body and also differentiate between conductor and insulator.
11. What are free and bound charges? How can you charge a metal rod negatively by the method of induction?

Numerical

1. A Spelunker is surveying a cave. She follows a passage 180 m straight west, then 210 m in a direction 45° east of south and then 280 m at 30° east of north. After a fourth Unmeasured displacement she finds herself back where she started. Use a scale drawing to determine the magnitude and direction of the fourth displacement.
2. A sphere of radius ' a ' moving through a fluid of density ' ρ ' with high velocity ' v ' experience a retarding force F is given by $F = Ka^x \rho^y v^z$, where K is a non-dimensional constant. Use the method of dimension, find the value of x , y and z .

3. A police Jeep is chasing a culprit going on a motor bike. The motor bike crosses a turning at a speed of 72km/hr. the jeep follows at a speed of 90km/hr, crossing the turning ten seconds later than the bike. Assuming that they travel at constant speeds, how far from the turning will the jeep catch up with the bike?
4. A body dropped from rest falls half of its total path in the last second before it strikes the ground. From what height was it dropped ?
5. An aluminium rod when measured with steel scale, both being at 25°C appears to be 1 m long. If the scale is correct at 0°C. What will be the length of rod at 0°C?
6. Using the following data, determine the temperature at which wood will just sink in benzene,
Density of benzene at 0°C = 900 kg/m³
Density of wood at 0°C = 880 kg/m³
Cubical expansivity of benzene = $1.2 \times 10^{-3} /K$
Cubical expansivity of wood = $1.5 \times 10^{-4} /K$
7. How much mercury must be placed inside a glass vessel of capacity 500 c.c., so that volume of the space unoccupied by mercury always remains constant.
8. A point source of light is 20 cm below the surface of a body of water. Find the diameter of the largest circle at the surface through which light can emerge from the water.
9. A glass rod is rubbed with silk and acquires a charge of magnitude 7.50 nC. What is the change in mass of the rod?

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SET B

Short Questions

1. The length of rod is exactly 1 cm. An observer records the readings as 1.0 cm, 1.00 cm, and 1.000 cm, which is the most accurate measurement.
2. Taking force, length and time to be fundamental quantities. Find the dimensional formula for the density.
3. Find the magnitude and direction of vector $\hat{i} + \hat{j}$.
4. Can you have zero acceleration but non-zero velocity? Explain with help of graph.
5. Can an object with constant acceleration reverse its direction? Explain.
6. Can an object have an eastward velocity experiencing a westward acceleration? Give reason.
7. Give with an example case where the velocity of an object is zero but its acceleration is not zero.
8. Why heat flows from the body at higher mean temperature to the body at lower mean temperature?
9. Frozen water pipes often burst in winter, will a alcohol thermometer break if the temperature drops below the freezing point of alcohol?
10. A student asserts that a suitable unit for specific heat capacity is $m^2/s^2 \text{ } ^\circ\text{C}$. Is it correct? Explain.
11. Which mirror is used as shaving or make up purpose and why?
12. A stick partially dipped in water seems to be bent, why?
13. Vehicles carrying inflammable fluid drag a chain along the ground, why?
14. Can two balls having same kind of charge on them attract each other? Explain.

Long Questions

1. Using the method of dimensions, derive an expression for the centripetal force F acting on a particle of mass m moving with velocity v in a circle of radius ' r '.
2. State triangle law of vector addition. Obtain an expression for the resultant of two vectors \vec{P} and \vec{Q} inclined at angle θ .
3. Define projectile. Show that the path of projectile projected horizontally from the top of tower is parabolic. At what angle does it hit on the ground?
4. A body is projected making an angle θ with horizontal. Show that its path is parabolic.
5. Define coefficient of expansion linear and cubical expansivities. Show that, $\gamma = 3\alpha$.
6. Distinguish between real and apparent expansion of liquid. Describe with mathematical detail a method to determine real expansivity of a liquid by Dulong and Petit method.
7. Define Thermal heat capacity of substance. Describe the method of mixture to determine the specific heat capacity of liquid.
8. Prove that $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$ for concave mirror when image formed is virtual, where notations has their usual meaning.
9. What is lateral shift? Derive an expression for its value. How does the lateral shift change with the increase in the angle of incidence?
10. What is surface charge density? How does it depend on the shape of conductor? Explain about action of point charge with suitable example.
11. What is electrostatics induction? How can you charge a given sphere positively by the method of induction?

Numerical

1. The resultant of two vectors \vec{A} and \vec{B} is perpendicular to vector \vec{A} and its magnitude is equal to half of the magnitude of vector \vec{B} . Find out the angle between \vec{A} and \vec{B} .
2. A disoriented physics professor drives 3.25 km north. then 4.75 km west and then 1.50 km south. Find the magnitude and direction of the resultant displacement using the method of components.
3. A baseball is thrown towards a player with an initial velocity 20m/s and 45o with the horizon. At the moment the ball is thrown, the player is 50m from

the thrower. At what speed and in what direction must he run to catch the ball at the same height at which it was released

4. A projectile is launched with an initial velocity of 30m/s at an angle of 60° above the horizontal. Calculate the magnitude and direction of its velocity 5s after launch.
5. The metal of a pendulum clock has linear expansivity of $1.85 \times 10^{-5} \text{ K}^{-1}$. The clock is correct at 20°C. How much will the clock gain or lose in 1 day if the temperature rises to 30°C?
6. A brass rod and a steel rod differ by 10 cm in length at all temperature. What are their lengths at 0°C.
7. A glass flask whose volume is exactly 1000 cm³ at 0°C is completely filled at 0°C. When flask and mercury are heated to 100°C, 15.2 cm³ of mercury overflow. If the cubical expansivity of mercury is 0.000182 /°C. Calculate the linear expansivity of given glass.
8. A meter scale is placed along the axis of convex mirror focal length 25 cm, its nearer end being at a distance of 50 cm. Calculate size of the image formed.
9. A polythene piece rubbed with wool is found to have a –ve charge of $3.2 \times 10^{-7} \text{ C}$
 - a. Estimate the number of electron transferred from which to which?
 - b. Is there a transfer of mass from wool to polythene?